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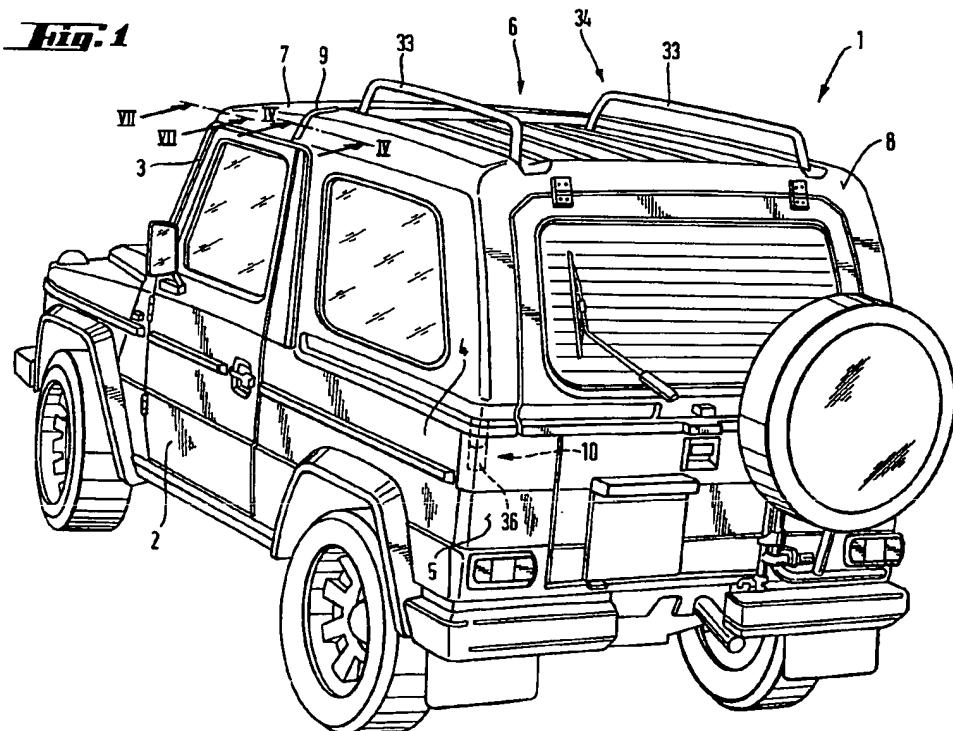
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(54) Improvements in detachable  
hard-tops for vehicles

(57) A detachable hard-top 6 of plastics material comprises a front roof section 7 and a cab stern section 8. The detachable hard-top 6 is intended for a vehicle 1 having sheet-metal windscreens mounting 3, front doors 2 and cargo area situated behind the two front seats. A roll-over bar 9 connecting the two sheet-metal bodywork sections receiving the front doors is situated between the windscreens mounting 3 and the cargo area of the vehicle 1. The front roof section 7 is positioned above the front seats and the cab stern section 8 is situated behind the front seats. The front roof section 7 and the cab stern section 8 form separate components and are connected to the vehicle 1 via fastening means 10 independently of each other. The stern section may cover the entire cargo area (as shown), or may cover just the rear of the cab.

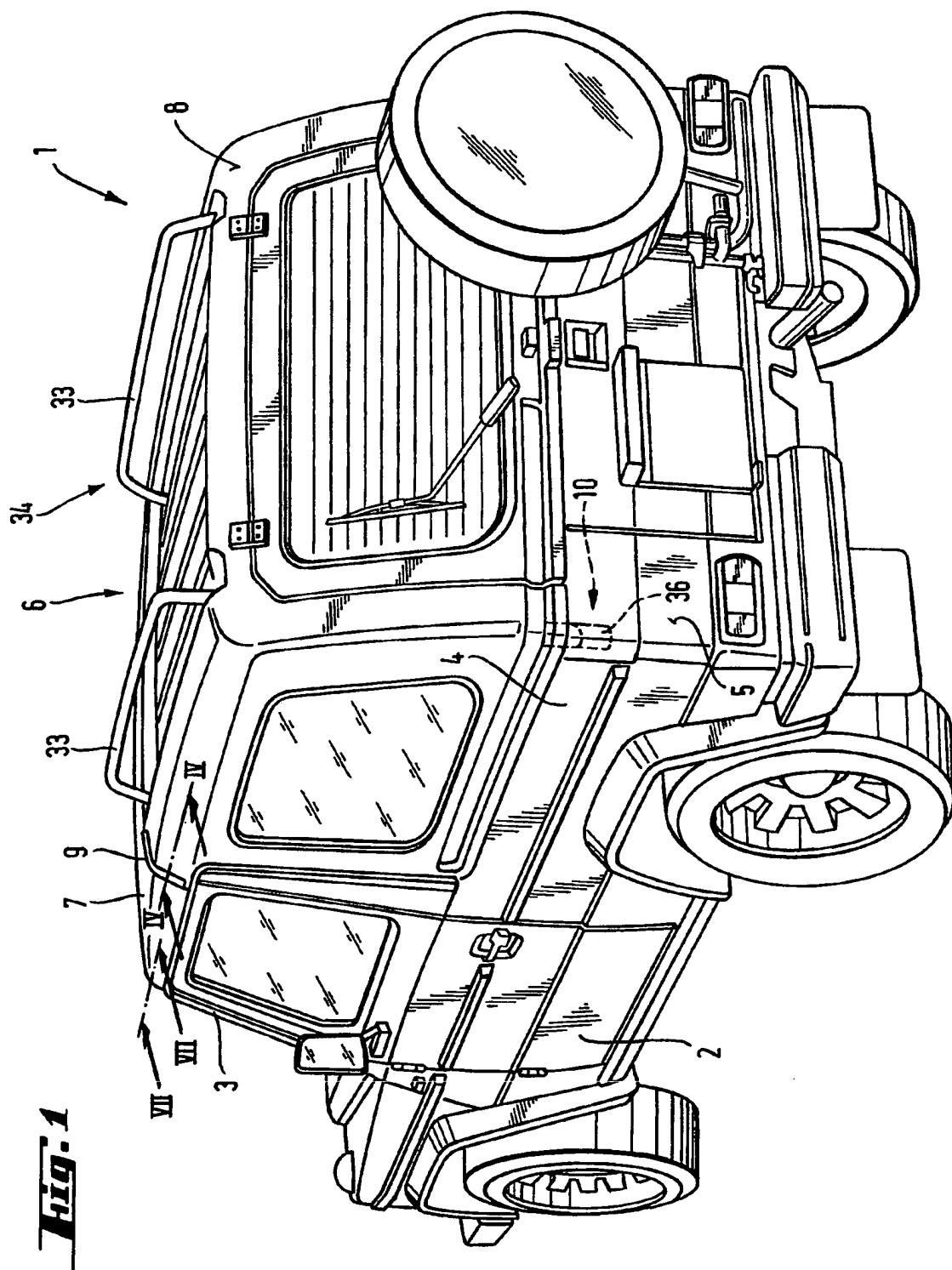
*Fig. 1*



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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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## SPECIFICATION

## Inventions in detachable hard-tops for vehicles

5 The present invention relates to detachable hard-tops of plastics material for vehicles having sheet-metal bodywork, comprising a windscreens mounting, two front doors, a cargo area situated behind the two front seats, as well as a roll-over bar situated  
 10 between the windscreens mounting and the cargo area and connecting the two sheet-metal frame elements receiving the front doors, which comprises a front roof section situated above the front seats and a cab stern section arranged behind the front  
 15 seats. Hereinafter such a vehicle will be referred to as "of the kind described".  
 The detachable hard-tops known at present are commonly utilised for cross-country vehicles as replacements for canvas hoods. As a result, they  
 20 comprise either a cab stern section only, or else a front roof section and a cab stern section. In the embodiment of a detachable hard-top commonly known as such, which comprises a front roof section as well as a cab stern section, these two sections are  
 25 commonly joined together in a coherent shape and constructed in one piece. Since these vehicles are commonly fitted with side doors in the region of the front seats, the front roof section forms a structural component freely overhanging from the cab stern  
 30 section. Accordingly, the detachable hard-top also has a comparatively great volume, is difficult to handle upon being installed on or removed from the vehicle, and requires considerable space for storage. There is a constant risk moreover that the freely  
 35 overhanging front roof section may be damaged during storage whilst the hard-top is out of use.

It is an object of the invention to provide a detachable hard-top which may be handled in uncomplicated manner upon being installed as well  
 40 as requiring as few alterations as possible, if any, to a series vehicle rigged for a canvas hood.

Accordingly, the invention consists in a detachable hard-top for a vehicle of the kind described, wherein the front roof section and the cab stern section form  
 45 separate components, and are joinable to the vehicle independently of each other via fastening means.

Thus, each separate component may be secured independently to the vehicle. In view of the smaller dimensions of the two components, these may  
 50 moreover be handled in substantially simpler manner and may in each case be secured singly and separately. A surprising result obtained by this  
 55 separate installation or construction of the front roof section and cab stern section, consists in that the front roof section may be raised or adjusted independently of the cab stern section, and that an optional application of the two components is  
 60 possible independently of each other. The ventilation in the region of the two front seats of the vehicle  
 65 may consequently be affected by means of the front roof section. The universal possibilities of application of the hard-top are enhanced moreover due to the form of the cab stern section unaffected by the front roof section, since the same may be constructed as a rear panel behind the front seats or as a

cover for the cargo area as a whole.

In one particular embodiment of the invention, the front roof section extends from the windscreens mounting into the area of the roll-over bar, and the

70 cab stern section from the roll-over bar to the cargo area extremity points away from the front seats. A perfect fit and weather-sealed connection of the roof sections to the vehicle may be obtained since the roll-over bar is co-opted as a supporting element for  
 75 both sections of the detachable hard-top. At the same time, the increased protection against injuries caused by an accident is retained by the inclusion of the roll-over bar in the detachable hard-top in case the vehicle is rolled.

80 In another embodiment of the invention, the cab stern section overlaps the roll-over bar in the direction of the front seats. The overlapping arrangement of the roof section allows of perfect sealing and anchoring of the cab stern section even at high  
 85 driving speeds.

Another embodiment is also advantageous, in which the front roof section projects over the roll-over bar in the direction of the cargo area and preferably rests on the front extremity of the cab

90 stern section, thereby accomplishing precise centering and bracing of the front roof section.

It is possible moreover for transition elements of the front roof section and of the cab stern section to be adapted to the shape of the roll-over bar for

95 sealing elements to be arranged between the transition element and the roll-over bar or between the transition element of the front roof section and the transition element of the cab stern section. Due to the sealing elements, not only is a very good seal

100 obtained in combination with the overlapping arrangement and penetration of water, but also against draught phenomena and noise, the sealing elements moreover acting as resilient supports between the different roof sections and the roll-over

105 bar, thereby preventing knocking of the elements on the bodywork.

In another particularly advantageous embodiment, the cab stern section extends between the rear side of the front seats and the extremity of the cargo area pointing towards the same, and is fitted with a transition element projecting over the roll-over bar in the direction of the front seats. Since the cab stern section is henceforth separate from the front roof section, it is possible without any great exertion to

115 obtain an enclosed or uncovered cargo area in the manner of a building block system, in each case under utilisation of the front roof section with different cab stern sections. This possibility of variation allows of a dual application of the front roof

120 section and thereby also of simpler storage of the detachable hard-top sections not in use at the time.

It is also possible for the front roof section to comprise hook elements which are constructed for pivotable mounting of the front roof section in

125 matching bearers of the windscreens mounting, and to have an end section facing towards the roll-over bar arranged to be adjustable at right angles to the vehicle floor with respect to the roll-over bar by means of an adjusting mechanism. Due to the

130 utilisation of fastening points situated on the vehicle,

rapid installation and disassembling of the front roof section may be accomplished, and the same may also be utilised simultaneously for ventilation of the passenger space.

5 In yet another embodiment of the invention, the adjusting mechanism is installed on bearers which are situated in the area of the extremity of the cab stern section facing towards the roll-over bar and positively joined thereto. Flush and secure mounting 10 of the two roof sections on the vehicle is obtained due to the incorporation of bearers engaging under the roll-over bar and to the bracing of the front roof section and cab stern section. In this case, it is unnecessary for fastening points to be provided 15 subsequently on the vehicle.

It may also be advantageous to provide the cab stern section with guiding rods extending approximately at right angles to the roof surface, which are insertible in vertical bores situated in the cargo area 20 in the terminal portion facing away from the roll-over bar. Due to conjoint utilisation of the tubular frame sockets required for the canvas hood, a centering action, as well as a fastening method appropriate for the vehicle, are obtained.

25 Advantageously, the guiding or locating rods are formed as tubular elements which project from the bottom edges of the cab stern section turned towards the lateral sides of the cargo area and form part of a supporting tube frame encircling the roof 30 corner sections and extending downwards to the tail corners. The installation of another roll-over bar in the cab stern section allows of greater safety of the passengers within the internal space and endows the cab stern section with great rigidity and torsional 35 stability. As a complement, this enables the roof of the cab stern section to be walked upon and vibration is substantially prevented even at high speeds.

If desired, the two corner sections facing away 40 from the roll-over bar may be embedded in expanded material together with the tubular sections of the locating rods to form massive corner posts or uprights preferably positively joined together by means of a glass-fibre mat enflanking the expanded 45 plastics material, thereby complementarily enhancing the effect of the roll-over bar formed by the tubular sections.

In another embodiment, the cab stern section 50 comprises recesses directed towards the middle of the vehicle, above the lateral sides, of the cargo area. This deep-drawn cab section increases the strength of the cab stern section in its lower portion facing towards the sides.

An angle section having its horizontal flange 55 extending approximately at right angles to the sidewall may be secured within the internal space of the cab stern section in the area of the recesses, the angle sections co-ordinated with the two sidewalls having a mutual spacing which corresponds approximately 60 to the spacing between the sides transversely to the longitudinal direction of the vehicle. This construction allows of subsequent adjustment and adaptation of the fastening elements to possible variations occurring during production in the dimensions between the two sides.

In another embodiment, the adjusting mechanism for the front roof section is used in the roll-over bar and is preferably formed by clamping locks. The fastening of the adjusting mechanism on the roll-over bar allows of secure anchoring on the vehicle and a high clamping force is thereby accomplished in the area of the seals between the front roof section and cab stern section.

65 In another particularly advantageous embodiment, the cab stern section is provided with clamping elements bearing from the inner side of the vehicle against the roll-over bar, which are fastened on the inner side of the cab stern section. Due to the clamping down of the front side of the cab stern 70 section with respect to the roll-over bar, the cab stern section is automatically braced against the locating rods in the stern section of the cab stern section in view of the sheet-metal connector elements inclined in the longitudinal direction of the 75 vehicle behind the front doors. An extremely satisfactory joint is obtained between the roof section and the vehicle by virtue of this clamping action. Finally, it is also possible for the clamping elements to be given bores which are arranged in 80 alignment with the bores in the upper corner sections of the roll-over bar. Due to conjoint utilisation of bores already available in the vehicle, it is possible to obtain a positive joint between the cab stern section and the vehicle without production of 85 new connecting elements.

In order that the invention may be more clearly understood, reference will now be made to the accompanying drawings which show some embodiments thereof by way of example, and in which:-

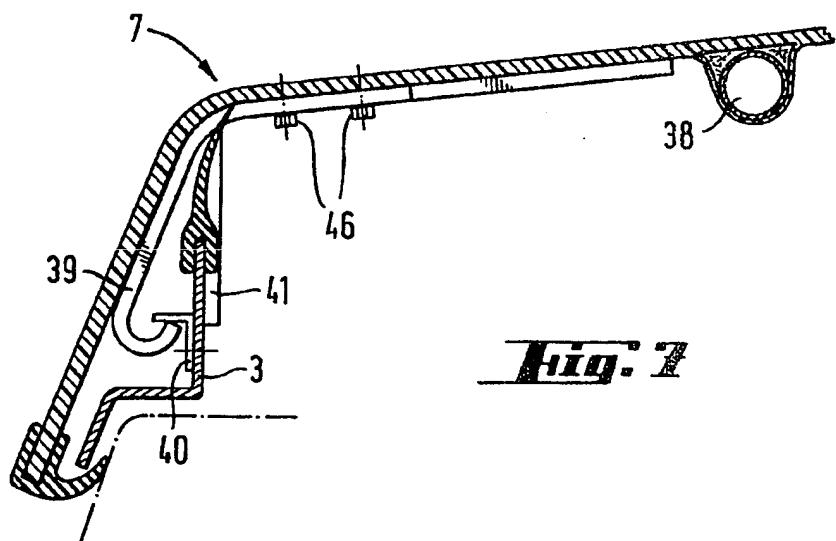
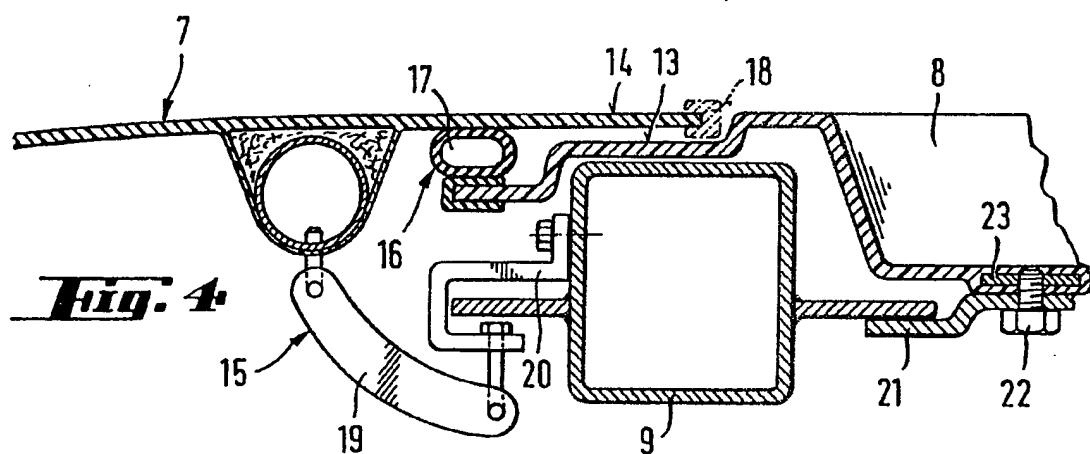
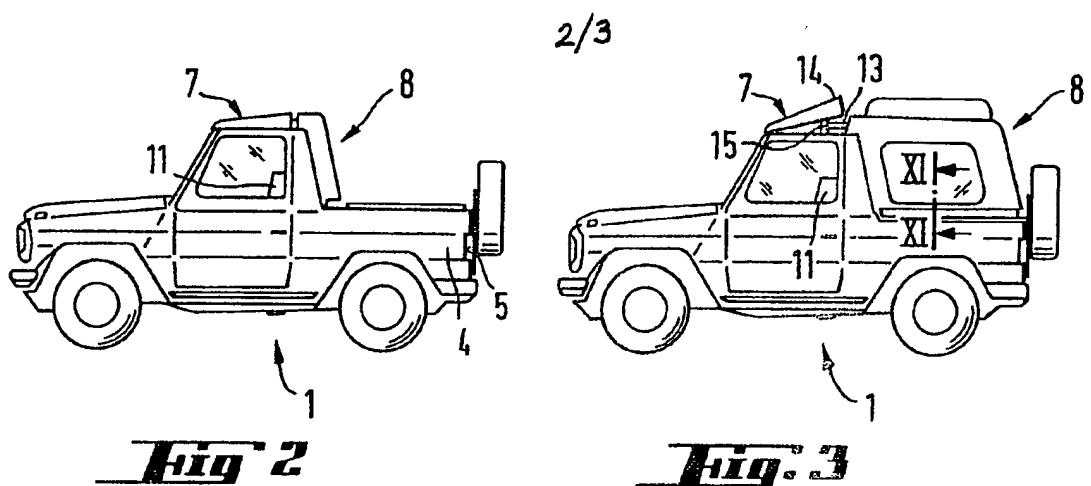
90 100 *Figure 1* shows a graphic illustration of a vehicle with a detachable hard-top of plastics material, *Figure 2* shows a side view of a vehicle in diagrammatical form with the front roof section raised,

105 *Figure 3* shows a side view of a vehicle in diagrammatical form with another embodiment of the cab stern section, *Figure 4* shows a cross-section through the front roof section in the longitudinal direction of the 110 vehicle in the area of the roll-over bar, along the lines IV-IV of *Figure 1*, *Figure 5* shows a cross-section through the corner post in the stern area of the cab stern section along the lines V-V of *Figure 6*,

115 *Figure 6* shows a graphic illustration of the cab stern section with the tubular supporting frame situated therein, *Figure 7* shows a cross-section through the front roof section in the longitudinal direction of the 120 vehicle in the area of its fastening points, along the lines VII-VII of *Figure 1*.

125 *Figure 8* shows a plan view of the front roof section with the tubular supporting frame situated therein, and *Figure 9* shows a cross-section along the lines IX-IX of *Figure 3*, transversely to the longitudinal direction of the vehicle, through the lower cab stern section facing towards the lateral sides.

130 Referring now to the drawings, a vehicle 1 which comprises sheet-metal bodywork, is illustrated in



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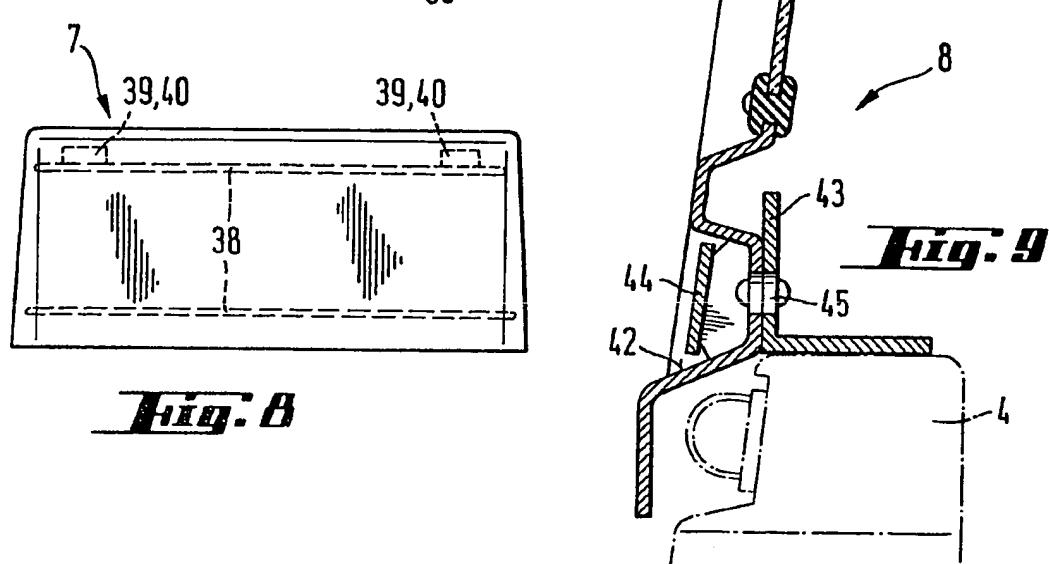
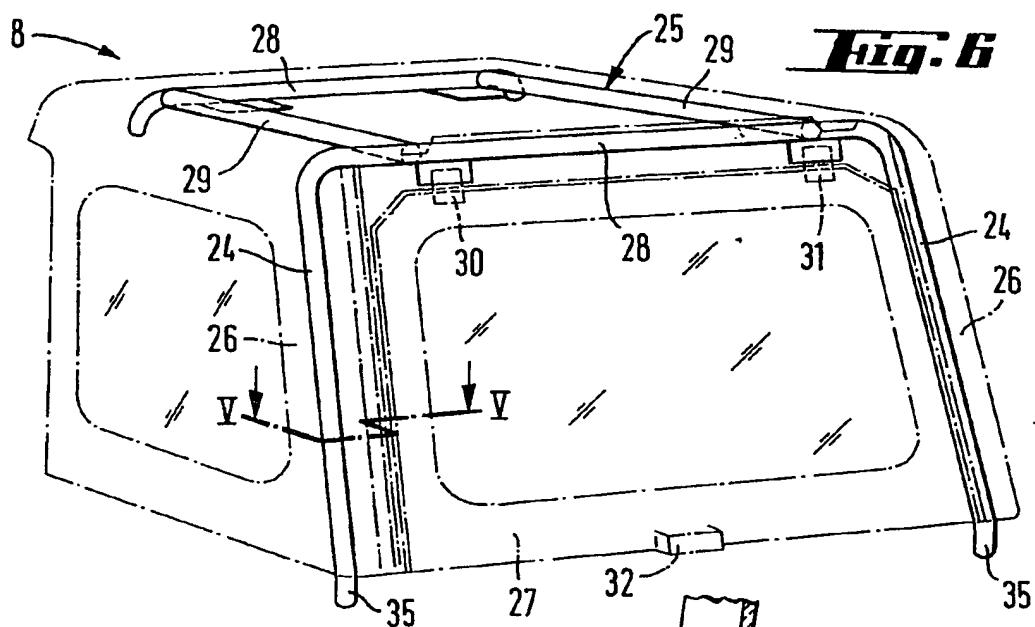
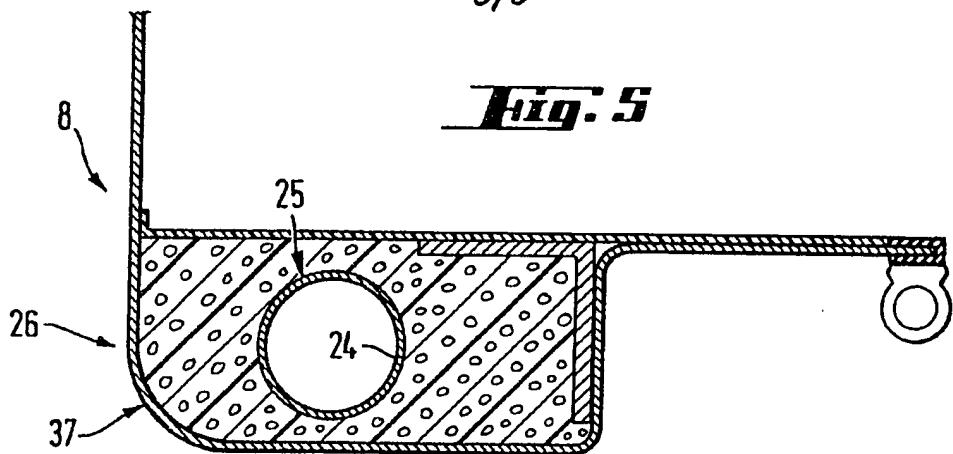
**Fig. 5**

Figure 1. The sheet-metal body is provided with front doors 2, a windscreens mounting 3 and sidewalls enflanking the stern section, comprising the lateral sides 4 and a tail side 5 which has a tail board inset 5 therein. A detachable hard-top 6 which is commonly also referred to as such, which comprises a front roof section 7 and a cab stern section 8, is located on the sheet-metal bodywork. The front roof section 7 and the cab stern section 8 in each case extend from 10 the front or rear roof extremity respectively, into the area of a roll-over bar 9 denoted by dotted lines. The front roof section as well as the cab stern section form individual components which are releasably connected to the vehicle by means of mutually 15 independent fastening means 10 of which one only is indicated diagrammatically in the stern area of the cab stern section 8 in Figure 1.

In Figures 2 and 3, it is shown that the cab stern section 8 may be constructed in different ways. In 20 Figure 2, the cab stern section 8 forms a driver's cab rear wall, i.e. it extends transversely to the longitudinal direction of the vehicle between the rear side of the front seats 11 and the extremity facing towards it of the cargo area 12 enflanked by the sides 4, 5. As 25 more clearly apparent from Figure 3, each of the cab stern sections 8 comprises a transition element 13 projecting over the roll-over bar 9 in the direction of the front seats 11. At the same time, it is apparent from this figure that the front roof section 7 has a 30 transition element 14 which projects over the transition element 13 of the cab stern section, situated in its terminal portion turned towards the cab stern section 8.

An adjusting mechanism 15 is arranged between 35 the vehicle 1 and the front roof section 7 for moving the roof from the idle position shown in Figure 2 into the upwardly pivoted position shown in Figure 3.

The manner in which the transition elements 13, 40 14 are arranged in the area of the roll-over bar 9 is shown in Figure 4. To obtain a smooth uninterrupted roof line for the hard-top, the roof surface of the cab stern section 8 is set back by the wall thickness of the front roof section 7 in the area of the roll-over bar.

This results in the transition element 13 of the cab 45 stern section 8 resting flush on the roll-over bar 9.

A sealing element 16, for example being a rubber chamber seal 17 in this case, is pushed onto the front edge of the cab stern section 8 facing towards the front roof section 7. As denoted by dotted lines 50 moreover, another sealing element 18 may, if needed, also be fitted between the transition element 14 of the front roof section 7 and the transition element 13 of the cab stern section 8. If two sealing elements 16, 18 are fitted in the area of the roll-over 55 bar 9, a complementary insulating chamber is formed apart from the labyrinth pattern established, so that even in case of high negative pressures in the area of the external skin of the roof elements, no traction phenomena occur in this area.

60 As apparent from the drawings moreover, the adjusting mechanism 15 for the front roof section 7 comprises a clamping lock 19 which is fitted on a bearer 20.

By contrast, the cab stern section 8 is secured by 65 means of the clamping elements 21 which bear

against the roll-over bar 9 from the inner side of the vehicle. The clamping elements 21 are joined to the cab stern section 8 by means of bolt connections 22. The bolt connections 22 are anchored in metal

70 inserts 23 which are embedded in the cab stern section 8.

The locating rods 24 which form part of the tubular supporting frame 25 are apparent from Figures 5 and 6. This tubular supporting frame 25 comprises, as

75 more clearly apparent from Figure 7, the two locating rods 24 arranged in the corner uprights 26, the cross-bearer 28 connecting the two and extending above the tail gate 27, and two stringers 29 extending in the upper corner portions in the

80 longitudinal direction of the vehicle, which may moreover also be interconnected by another cross-bearer 28 in the area of the roll-over bar 9 in the case of superstructures for heavy roof loads. Appropriate metal fittings wherein may be anchored the screws

85 for fastening the hinges 30, 31 for the tail gate 27, the lock elements for the lock 32 of the tail gate 27, as well as the hinges for the gas spring for the raising of the tail gate 27 and for the tubular elements 33 of the roof rack 34 - see Figure 1 to this end - are secured on

90 the stringers 29 and the cross-bearers 28, as well as the locating rods 24.

The locating rods 24 whereof the tubular elements 35 projecting beyond the bottom edges of the cab stern section 8 may be inserted into vertical bores 36

95 of the tail side 5, are moreover embedded in the corner uprights 26 formed by filling the corner portions 37 by expansion of a material. To obtain a high resistance against withdrawal of these tubular elements 35 establishing the anchoring of the cab

100 stern section 8 on the vehicle 1, the corner upright 26 formed by expansion of a material is complementarily positively joined to the adjacent sections of glass-fibre-reinforced plastics material via glass-fibre-reinforced polyester layers.

105 In Figure 7 is illustrated the front extremity of the front roof section 7 which is provided for reinforcement with cross-bearers 38 extending transversely to the longitudinal direction of the vehicle, which are embedded in the roof section. The front roof section

110 7 is moreover joined to hook elements 39 which are also advantageously embedded in the front roof section. These engage in a mating bracket 40, the latter being arranged on the vehicle in the area of the windscreens mounting 3. Thrust shackles 41 are

115 situated at the side of the windscreens mounting 3 opposed to the mating brackets 40, and comprise angular elements which, when installed, bear against the windscreens mounting. A lipped sealing section covering the gap with the front roof section 7

120 is situated on the upper side of the windscreens mounting 3.

A lipped sealing section for sealing the gap with the windscreens mounting 3 is complementarily also installed on the front edge of the front roof section 7.

125 In Figure 8, it is shown that for reinforcement purposes in the longitudinal and transverse directions, the front roof section 7 is also provided with at least two cross-bearers 38 which are embedded in the roof section formed from glass-fibre-reinforced

130 plastics material. The hook elements 39 which

engage in the mating brackets 40 in the area of the windscreens mounting 3 are fastened on the cross-bearers which are situated at the front in the direction of travel. The thrust shackles 41 are also anchored in these cross-bearers 38. The parts of the clamping elements 19 facing towards the front roof section 7 are fastened on the cross-bearer 38 which is situated at the rear in the direction of travel. The thrust shackles 41 merely serve the purpose of

10 preventing the hook elements 39 from being unhooked in the area of the windscreens mounting 3 during the upward pivoting of the front roof section, above all whilst the front roof section 7 is being pivoted upwards.

15 The lower cab stern section in the area of the lateral sides 4 is illustrated in Figure 9. A recess 42 in whose area an angle section 43 is connected to the cab stern section 8 by bonding or via mechanical fastening elements, is incorporated to increase the strength of the cab stern section 8 in the area of its contact on the side 4. Possible tolerances in the dimensions of the spacing transversely to the longitudinal direction of the vehicle between the lateral sides 4 may be taken up by appropriate spacing

20 elements or by a correspondingly wider construction of the horizontal flange of the angle section 43. It is possible moreover for an ornamental or embellisher strip 44 to be fitted in the area of this recess 42, whereby possible fastening means between the cab stern section 8 and the angle section 43 may be hidden. Further more, it is possible however to provide openings 45 in the cab stern section behind an embellisher strip 44 of this nature. These openings may be utilised for ventilating the inside space

25 of the vehicle with the hard-top mounted.

The hard-top is fitted by inserting the tubular sections 35 of the cab stern section 8 into the vertical bores 36 of the vehicle and the top is folded down over the roll-over bar 9. The transition element 13 of the cab stern section 8 is pressed flush against the roll-over bar 9 by means of the two clamping elements 21 which after the cab stern section is laid on are joined to the same via screw connections. Due to being clamped down in this manner, by

40 means of the clamping elements 21, the cab stern section 8 is forced over the sheet-metal body elements extending obliquely behind the front doors 8, in the direction of the vertical bores 36, and the tubular elements 35 are thereby braced against the

45 body of the vehicle. This results in the firm and reliable seat of the cab stern section even during cross-country travel, so that no deleterious noises or draughts occur in the internal space.

After installing the cab stern section 8, the front roof section 7 has its hook elements 39 hooked into the matching brackets 40 of the windscreens mounting 3, and also has its transition element 14 folded down onto the transition element 13 of the cab stern section 8. It is connected to the eccentric tensioner 19 in the folded-down condition. After the front roof section 7 is connected to the eccentric tensioner 19, the thrust shackles 41 bearing against the inner side of the windscreens mounting 3, are installed.

Installing the cab stern section constructed as the

60 rear wall of the driver's cab is effected by pushing its

transitions element 13 over the roll-over bar 9 and is then clamped fast to the roll-over bar by means of clamping elements 21. In the area of the cargo area 12 of the vehicle 1, the connection is made by means

70 of rapid connectors or via mechanical fastening means. Appropriate sealing elements may be incorporated for sealing the inner space between the cab stern section 8 formed as the rear wall of the driver's cab and the cargo area 12.

75 The inserted elements for securing locking or anchoring points in the hard-top preferably produced from glass-fibre-reinforced polyester, in particular such as the tubular supporting frame, are embedded in the moulded elements to assure

80 satisfactory force introduction.

The production of the front roof section and of the cab stern section may just as well be performed by deep-drawing of plastics material foils or panels or of sheets of metal or of non-metallic material. If use

85 is made of deep-drawn plastics material foils, a glass fibre laminate may be applied on the inward side of the roof sections to increase the strength. A twin-sheath sandwich form of the roof sections is particularly advisable for higher roof loads.

## 90 CLAIMS

1. A detachable hard-top for a vehicle of the kind described, wherein the front roof section and the cab stern section form separate components, and are joinable to the vehicle independently of each other via fastening means.

2. A detachable hard-top as claimed in claim 1, wherein that the front roof section extends from the

100 windscreens mounting into the area of the roll-over bar and the cab stern section extends from the roll-over bar up to the extremity of the cargo area facing away from the front seats.

3. A detachable hard-top as claimed in claim 1 or

105 2, wherein the cab stern section is constructed to project over the roll-over bar in the direction of the front seats.

4. A detachable hard-top as claimed in claim 1, 2 or 3, wherein the front roof section is constructed to

110 project over the roll-over bar in the direction of the cargo area and rests on the front extremity of the cab stern section.

5. A detachable hard-top as claimed in any of claims 1 to 4, wherein transition elements of the

115 front roof section and of the cab stern section are adapted to the shape of the roll-over bar and sealing elements are situated between the transition element and the roll-over bar and respectively or between the transition element of the front roof

120 section and the transition element of the cab stern section.

6. A detachable hard-top as claimed in claim 1, wherein the cab stern section extends between the rear side of the front seats and the extremity facing

125 theretowards of the cargo area and is provided with a transition element projecting over the roll-over bar in the direction of the front seats.

7. A detachable hard-top as claimed in claim 1, wherein the front roof section has hook elements

130 which are formed for the pivotable mounting of the

front roof section in mating brackets of the wind-screen mounting, and is adjustably fitted in the terminal portion facing towards the roll-over bar with respect to the roll-over bar at right angles to the 5 floor of the vehicle, by means of an adjusting mechanism.

8. A detachable hard-top as claimed in claim 7, wherein the adjusting mechanism is installed on bearers which are situated in the area of the 10 extremity facing towards the roll-over bar of the cab stern section and are joined to the same in positive manner.

9. A detachable hard-top as claimed in claim 1, wherein the cab stern section comprises locating 15 rods extending approximately at right angles to the roof surface, which are insertible in vertical bores situated in the cargo area in the terminal portion facing away from the roll-over bar.

10. A detachable hard-top as claimed in claim 9, 20 wherein that the locating rods are constructed as tubular elements of a tubular supporting frame extending enflankingly in the roof corner areas and downwardly in the stern corners, which project beyond the bottom edges of the cab stern section 25 which face towards the lateral sides of the cargo area.

11. A detachable hard-top as claimed in claim 10, wherein the corner areas facing away from the 30 roll-over bar are embedded in expanded material together with the tubular elements of the locating rods to form a massive corner upright, and are positively joined together by means of fibre glass mat enflanking the expanded plastics material.

12. A detachable hard-top as claimed in any of 35 the preceding claims, wherein the cab stern section comprises recesses directed towards the centre of the vehicle ab ve the lateral sides of the cargo area.

13. A detachable hard-top as claimed in claim 12, 40 wherein an angle section extending with its horizontal flange at approximately right angles to the sidewall is secured in the internal space of the cab stern section in the area of the recesses, the angle sections co-ordinated with the two sidewalls having a mutual spacing which approximately corresponds 45 to the spacing between the sides transversely to the longitudinal direction of the vehicle.

14. A detachable hard-top as claimed in any of 50 the preceding claims, wherein the adjusting mechanism for the front roof section is provided on the roll-over bar and is formed by clamping locks.

15. A detachable hard-top as claimed in any of 55 the preceding claims, wherein the cab stern section is provided with clamping elements bearing against the roll-over bar from the internal side of the vehicle, which are fastened on the inner side of the cab stern section.

16. A detachable hard-top as claimed in claim 15, 60 wherein the clamping elements are provided with bores which are situated in alignment with the bores in the upper corner areas of the roll-over bar.

17. Detachable hard-tops substantially as hereinbefore described with reference to the accompanying drawings.

18. A vehicle fitted with a detachable hard-top as 65 claimed in any of the preceding claims.

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